

PICTURE OF THE MONTH

A Nighttime Infrared View

FRANCES C. PARMENTER

Applications Group, National Environmental Satellite Service, NOAA, Suitland, Md.

Infrared (IR) data are being received operationally from NOAA 1 and from the improved TIROS operational satellite, ITOS 1. These satellites provide an important nighttime view of the earth that supplements the simultaneous video and IR coverage (Anderson 1970) received during the day. Figure 1 is a photographic display of the ITOS 1 nighttime data recorded at 1015 GMT on Jan. 14, 1971.

Land areas cool rapidly after sunset and appear light in color in the nighttime IR data. Relatively warmer water bodies appear dark. A cloud-free portion of the Rocky Mountains can be seen stretching northward from (A) to (B). Clear skies in western Texas reveal a dark threadlike terrain pattern. These darker lines (C) delineate warmer terrain and vegetation regions. In contrast to the Texas terrain is the colder snow-covered ground in Kansas (D).

At the time (1015 GMT) of this picture, cold air and generally clear skies accompanying an advancing Arctic High covered much of the Central United States. At 0900 GMT, a weak frontal system was analyzed to stretch from a Low over Lake Superior southeastward into Ohio and then southwestward across the Texas Panhandle into Mexico. The 0900 GMT position of the surface front seen in figure 2 appears from (E) to (F) on the IR data. In this case, the front is not marked by an area of bright multi-layered or convective clouds. Instead, warm moist air

from the Gulf of Mexico, combined with the advancing cold air, has produced an area of fog, stratus, and light rain along a portion of the front that stretches from Kentucky to the "boot heel" of Missouri. The tops of the fog and low clouds in this area are warm and relatively dark.

Fog and stratus, both behind and ahead of the front, (C) to (G), also cover parts of Kansas, Oklahoma, Missouri, and Arkansas. The edge of the low cloud deck is shown in figure 3. The cloud tops are warmer than the cold earth immediately to the north; thus in this picture, the area of low clouds appears darker than the area of clear skies. Radiosonde reports (fig. 3) taken 2 hr after the picture (1200 GMT) indicate that the cloud tops in this area range between 1,900 and 3,200 ft. Note the gradual changes in cloud color (gray to black) as the cloud-top temperatures increase from -7°C at Topeka, Kans. (G), to $+17^{\circ}\text{C}$ at Little Rock, Ark. (H).

Some high-level cirrus clouds emanating from a developing Low north of (F) extend eastward over a portion of this low cloud area. The sounding from Oklahoma City, Okla., indicates that the base of these clouds was 22,000 ft.

The area of cloudiness southeast of the front marks a region of strong southerly flow at all levels. The northern edge of the cirrus formation extends from central Texas northeastward into Kentucky. The high, thin cirrus clouds south of (C) appear warmer than those over Okla-

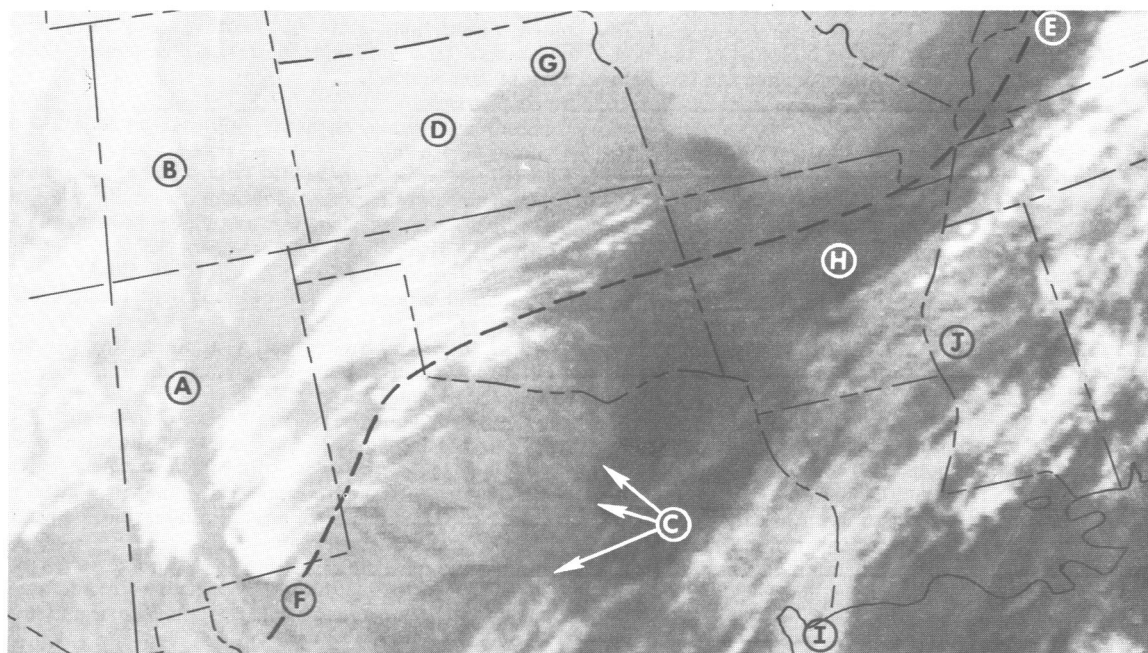


FIGURE 1.—ITOS 1 view, pass 4453, at 1015 GMT on Jan. 14, 1971.

homa because thin cirrus is transparent to some of the warmer radiation coming from the underlying surface.

Rain showers and thunderstorms are reported throughout the area around ① and northeastward from ②. Radar reports (0945 GMT) indicated the cloud tops near ① ranged from 10,000 to 16,000 ft. Farther north, a line of bright convective clouds can be seen extending northeastward from ③. The tops of these heavy thunderstorms were reported to range from 24,000 to 28,000 ft.

IR data provide as much and sometimes more informa-

tion on relative cloud heights and temperatures than the video data. These additional nighttime IR data give meteorologists an intermediate observation of the cloud systems; but more important, meteorologists will be able to study the diurnal and dynamic changes within these systems.

REFERENCE

Anderson, Ralph K., "Picture of the Month—An Atlantic Cold Front, Satellite Infrared and Visual Data Compared," *Monthly Weather Review*, Vol. 98, No. 12, Dec. 1970, pp. 934-935.

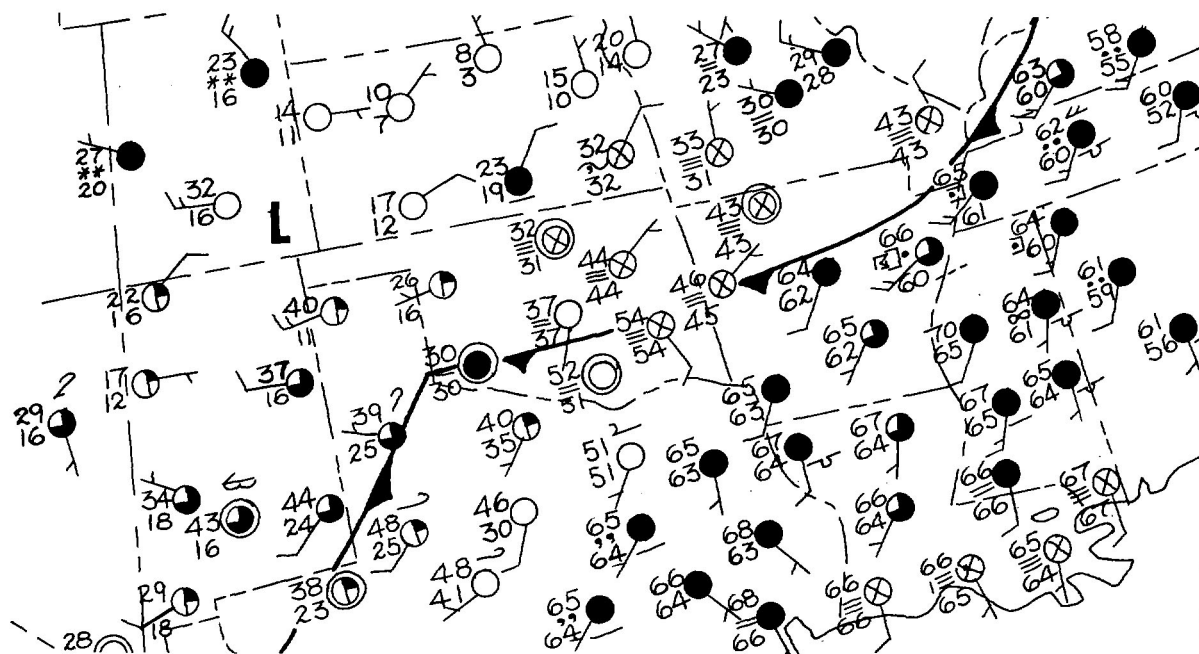


FIGURE 2.—Surface reports at 0900 GMT on Jan. 14, 1971.

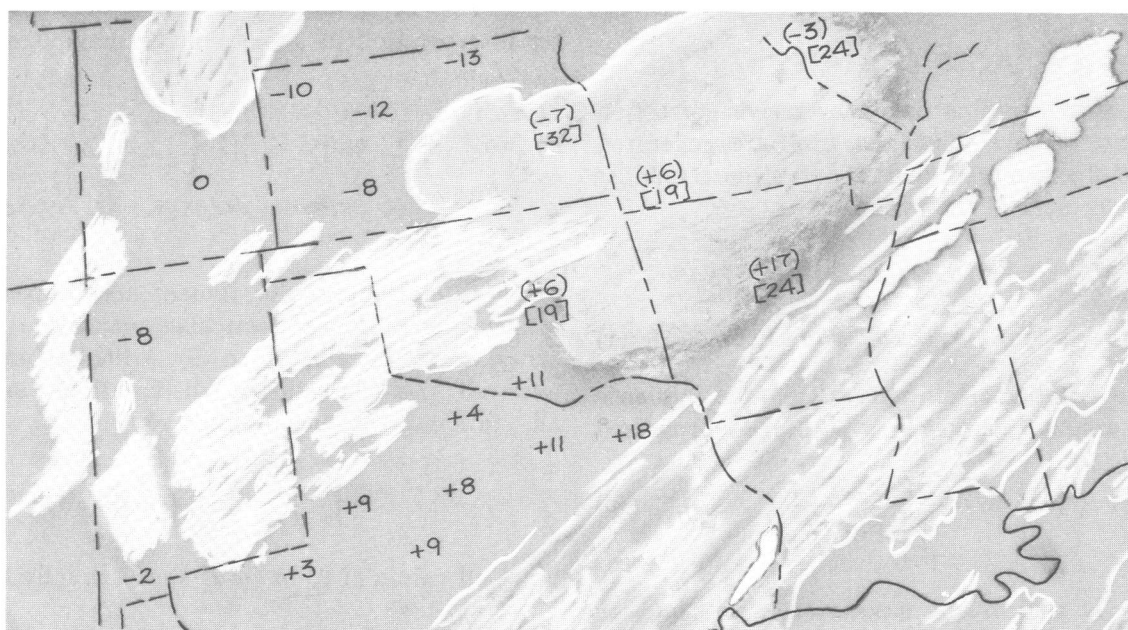


FIGURE 3.—Composite nephanalysis: height of clouds in hundreds of feet, cloud-top temperatures ($^{\circ}\text{C}$), and ground temperatures ($^{\circ}\text{C}$).